

THE PROCEEDINGS OF THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

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ROYAL ENTOMOLOGICAL SOCIETY
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VOLUME 17.

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HENRY SMEATHMAN [?-1786]

By Francis J. GRIFFIN.

HENRY SMEATHMAN, author of "Some account of the termites, which are found in hot Climates" published in 1781 (*Phil. Trans. Roy. Soc.* 71 : 139-192, 4 pls.), is one of the least known entomologists despite the fact that this work is probably one of the most widely quoted of any on Natural History.

Hagen 1863 (*Bibl. Ent.* 2 : 168) states that he was a teacher of languages, that he travelled in Africa and died in 1787. Smeathman certainly visited Africa, even though his travels were restricted, but he died in 1786 and not 1787 as is proved by his obituary notice published in 1786 (*Gentleman's Magazine* 56 (2) : 620) as follows : "At his apartments in Cannon-str. Henry Smeathman, esq.; of Clements-inn, author of the history of the Termites or Black [sic] Ants. See *Phil. Trans.* vol. LXXI. p. 139, and our vol. LI. p. 526. He was also author of the humane plan for the comfortable and free settlement of Black Poor on the Coast of Africa (see p. 504), and of many ingenious treatises not yet published. He was sometime secretary to the London Chamber of Commerce."

Apart from this obituary notice little published information is available concerning Smeathman, and that little is widely scattered in different publications of a non-entomological nature. For this reason I have gathered together the scraps and added such unpublished information as I can find. The result is a story not without interest despite the passing of over a century and a half since Smeathman's death.

In Smeathman's day Africa was still very much the "Dark Continent," slave trading was still an active pursuit, and America was still a British Colony. In all these Smeathman played a part, for he visited Africa for 4 years and left that continent to reside in the West Indies, he propounded a plan, which was adopted after his death, for the settlement of liberated slaves in West Africa, and was in close contact with several of the leading actors in the events concerned with the loss of America as a British Colony. His visit to Africa was primarily to collect specimens, but he corresponded with Linnaeus and sent him undescribed plants from Africa. He was apparently connected with the law, for he is described as "of Clements-inn", and was for a time Secretary to the London Chamber of Commerce. He is known to have invented an aeroplane and to have experimented with balloons. In short, his life was full of activity and endeavour.

It is in connection with his visit to Africa that Smeathman is of most importance to Entomology. Much information on this episode in his life is to be found in an unpublished letter-book of Dru Drury covering the years 1761 to 1783, which covers the whole period of Smeathman's stay in Africa. This interesting volume, in Drury's handwriting, was presented to the British Museum (Natural History) in June 1937 by Mr. Charles Dru Drury of Sunderland, a descendant of its author, and I am indebted to Mr. Riley of the British

Museum, in whose charge the volume now is, for enabling me to consult it in London. The story of the volume has been told by Professor T. D. A. Cockerell in 1922, "Dru Drury, an eighteenth century Entomologist", *Scientific Monthly* 17 : 67-82.

Dru Drury, who lived from 1725 to 1804, was a London Goldsmith who became Goldsmith to the Queen. He is best known today on account of his great work in 3 volumes entitled *Illustrations of Natural History* 4to. 1770-1782. According to the letters, Drury invited Smeathman to write the third volume of the work in 1773, but the offer was declined. He was a great collector of insects, and Leach in 1815 (*Edinburgh Encyclopedia* 9 : 66) says of his collection that it "was one of the most extensive ever made, and is said to have contained, in species and varieties, no less than 11,000 insects, (in his time the largest collection,) . . . he offered sixpence an insect for all insects, 'from the size of a honey-bee upwards'. His Museum of Entomology was disposed of, in London, by public auction, and produced about six hundred pounds. One insect, viz. *Scarabaeus Goliathus*, (*Goliathus magnus*,) was purchased by Mr Donovan, for twelve guineas and a half, who obtained also all the British insects, (which were very numerous,) collected by Mr Drury, and now enrich his splendid museum." I understand that a copy of the sale catalogue is in the Hope Department at the Oxford Museum. Late in his life Drury became bankrupt but, with the help of his friends, his fortune was to some extent re-established. He lies buried in the church of St. Martins in the Fields in London. Drury was the President of one of the first recorded entomological societies "The Society of Entomologists of London [1780-1782]" (see Griffin, 1940, *Proc. R. ent. Soc. Lond.* (A) 15 : 51). It is quite apparent from his letters that he was on the friendliest of terms with Smeathman and it is possible that the original suggestion that Smeathman should visit Africa was made by Drury. Seventeen letters from Drury to Smeathman are included in the collection covering the years 1768 to 1775 which spans the period of Smeathman's voyage.

In the eighteenth and early nineteenth centuries it was no uncommon thing for wealthy patrons to send collectors abroad to enrich their collections. At that time the formation of private museums was more common than it is today. Many of these subsequently became part of the British Museum, where they are still available for the student to consult. It may be added in passing that strange objects often found their way into such private collections as, for example, the so-called "mermaids," for which large prices were paid. It was not till later that such specimens were proved to be the production of ingenious sailors. It is obvious that Smeathman left England to collect for his "Subscribers" Dru Drury, John Fothergill, Marmaduke Tunstall, Joseph Banks, and, later, the Dowager Duchess of Portland. Drury acted as a sort of Secretary to the venture and conducted all the correspondence with Smeathman. It is this correspondence which has produced the greater part of my information. Dr. John Fothergill, a Quaker, was a very successful medical practitioner who lived from 1712 to 1780, and among other interests maintained a world-famous botanic garden in which he raised many plants and trees not previously grown in this country. He maintained a correspondence with naturalists throughout the world, especially with America, which country he visited. He was a great philanthropist and by reason of his connection with the Friends, played an active part in the negotiations which led to the end of the personal proprietorship of Pennsylvania. In addition he was asked by the Colonists to intercede in the attempts made to prevent the war between America and the mother country. He was known personally to Benjamin Franklin. The full story of his life is told in R. H. Fox's book *Dr. John Fothergill and his friends* published in 1919.

Marmaduke Tunstall, who lived from 1743 to 1790, formed a large museum, chiefly of birds, which was sometime known as the Tunstall Museum and now forms part of the Museum of the Natural History Society of Northumberland, Durham and Newcastle-upon-Tyne. His best-known work is the rare *Ornithologia Britannica*, a folio of 6 pages first published in 1771 and re-issued as a facsimile by the Willughby Society in 1880. The work contains the first description of some of our British Birds.

Sir Joseph Banks, who lived from 1743 to 1820, was for many years President of the Royal Society. He was a great collector and formed a famous library the catalogue of which is still in constant use as a bibliographical tool. He played an active part in the early history of Australia, which he visited with Captain Cook. Fuller details of his life are to be found in Maiden, 1909, *Sir Joseph Banks: the Father of Australia*.

The Dowager Duchess of Portland (Margaret Cavendish Bentinck) formed a great private museum, including especially Mollusca. The contents were sold by auction in 1786 at a sale which lasted 38 days. She became one of Smeathman's subscribers in 1773.

These then were the patrons for whom Smeathman went to Africa to collect specimens.

The first mention of the scheme is in Drury's letter to Smeathman of 23.vii.1771, which does no more than refer to the offer of help from "Mr. Tiese" which had been obtained by Fothergill. It seems that the initial subscription was £100 from each subscriber; a further subscription of £30 was made in 1773 when the Duchess of Portland, who paid both subscriptions, joined the scheme. In return for this payment Smeathman was to send home collections of insects, birds, plants, seeds, shells and the like and these were to be divided among the subscribers until each had received a sufficient return for his or her payment. A further 10 guineas was paid later in 1773.

So far as I can discover, Smeathman departed either late in 1771 or early in 1772 and originally he undertook to collect only for Drury, Fothergill and Tunstall, for on 21.viii.1771 Drury wrote: "When ye subscribers have all agreed on ye principal Articles of the Division nothing will obstruct your immediate preparation. Last Thursday I was with Dr Solander & Mr Banks when *you* was ye subject of our conversation. Mr Banks seemed heartily willing to join with your subscribers & therefore must be waited on when you come to town." Obviously Banks was duly "waited on" and agreed to join the subscribers. The next mention of the voyage is in Drury's letter of 1.iii.1772, by which time Smeathman had obviously reached Africa. It is addressed to "Sierra Leon Bancee Island" and is a long letter, which shows clearly how friendly Drury and Smeathman were. Drury is quick to express the hope that "Seasoning" is successfully passed, for this he regarded as Smeathman's greatest danger. "The peril of encountering wild beasts & the *Baboons* wh. Dr. Tiese's friend told us off," he wrote, "I consider in a very different light from ye other; these may be overcome by courage skill and cunning." He then gave a little advice to his friend "... let me have none of your damned large scrambling characters that wont allow you to put above 6 words in a line ...". Drury wrote a small, legible, hand.

A month later Drury had received 2 letters from Smeathman and in acknowledging them is somewhat sarcastic. "You will make a fine F.R.S. truly to stuff your letters with variations of ye wind, ye needles, latitude &c when you should be describing some of Nature's Beauties out of the three Kingdoms." Smeathman was not, however, despite his meteorological observations, elected a Fellow of the Royal Society, but the letter is interesting, and went on to

describe a visit made by the Duchess of Portland to Drury's collection of insects. The visit, which lasted some hours, pleased the Duchess and she expressed her hope that she might be able to acquire some of the duplicates Smeathman would doubtless be sending home. This was obviously the origin of her joining the subscribers. The next part of the letter is amusing. Drury related that he had been commissioned to paint some pictures for Madame Schwellenburg, one of the Queen's ladies and, as a result, had been appointed Goldsmith to the Queen. In telling this to Smeathman, Drury's pen wandered and he wrote: "Lord how I should rejoyce to see him [Smeathman] made *Butterfly catcher* to the Queen! Risum tenealis? But softly Dru where are you rambling to get firm upon the first step before you attempt to mount the second. True so I will; & therefore I will stop here." But stop he did not! Having proceeded to describe the many visitors to his collection he wrote: "I might have many opportunities of obliging them with some Duplicates & as I have my business and interest to pursue might establish and extend both by this means if therefore you could send me a parcel of perfect ones by a private ship I should be exceeding glad it would be very beneficial to me many ways the amount you should direct me who to pay it to, but in doing this you must be secret, nor would I wish to have many scarce ones that you send to your subscribers common ones would answer very well if they differed from what have been hitherto received from China &c." I find this a somewhat remarkable suggestion for Drury to make, more especially as he was one of the subscribers, but it proved acceptable to Smeathman, for Drury wrote on 28.i.1773: "I am glad you approve the hint I gave you of sending a private Box to England believe me it may turn out to yr advantage. It may—It will." In due course the specimens arrived and on 30.xi.1773, by which time only one small parcel had reached the subscribers, Drury wrote to tell Smeathman that he had already sold some £20 worth and he hoped to dispose of the remainder, possibly in Holland. Eventually the insects realised £42 6s. 0d. as follows: Revd. Mr. Wickham £15 6s., Henry Seymour £12 6s., — Sepp, of Amsterdam, £14 14s.

Possibly encouraged by this success, Smeathman soon proposed to start trading for rice along the coast, but to do this obviously a boat was necessary and request was made for one to be provided. Drury was nervous of the suggestion and advised his correspondent to proceed very slowly and only after careful consideration. Above all, great care must be taken to ensure that the subscribers heard nothing of the scheme. The suggestion of the boat was received favourably, however, and it was proposed to buy a suitable vessel in England and send it out to Smeathman. Drury in his letter of 30.xi.1773 promised to press the matter with the Secretary of the Admiralty but apparently no success resulted. This was possibly due to a disagreement between Banks and the Government at that time, for it is unlikely that Drury intended to make the appeal by means other than Banks' mediation. Drury next raised the matter at a meeting of the subscribers but Banks objected to the proposal and expressed the view that the provision of a boat for Smeathman would invite a wandering and rambling disposition and should be discouraged. Smeathman's brother, meanwhile, had been making enquiries and thought it would be best to buy a boat "with a cabin and deck" in London and send it out to his brother in Africa. This he estimated would cost £15 to £20. But this scheme like the others came to nothing, and Drury next suggested that goods should be sent out to Africa which Smeathman could sell and with the proceeds purchase a craft suitable for his purpose. He was advised that a 10-ton boat would cost some £60 in London and that the expense of sending it to Africa would cost a similar sum. In an attempt to get matters moving, Drury gave Smeathman authority

to draw on him up to £25 at not less than 28 days. Still no result was obtained and the final proposition came from Fothergill in a special letter which he wrote to Smeathman and which Drury forwarded on 4.i.1774. Fothergill's suggestion was for the immediate return of Smeathman to England, even if that necessitated chartering a special vessel for the purpose. A boat would then be fitted out to suit Smeathman's requirements and he could go to Africa until the onset of the rains and then return to England. The appeal had no effect, however, and on 22.xi.1775 a last effort was made to get Smeathman to come home. By this time Fothergill's scheme for the provision of a boat had received the blessing of his fellow-subscribers, stress being laid on the fact that times were especially propitious, since many vessels were laid up at Liverpool because of the disturbances in America. But nothing happened and Smeathman eventually went to the West Indies and, so far as I am aware, never returned to Africa.

The subscribers received many complaints from Smeathman, but the immense difficulties under which he worked must be borne in mind. The long delay in correspondence, due to boats returning from Africa via the West Indies, the primitive conditions under which he doubtless lived and worked and perhaps above all the climate generally all tended to make life unbearable. On the other hand, the subscribers were mainly interested in the receipt of collections and none arrived. Drury, when writing on 20.xi.1772, while sympathetic to Smeathman's complaints at the housing conditions under which he had to live, found himself forced to remind Smeathman that the subscribers had so far received no specimens in return for the money they had paid and were somewhat understandably restive on that account. As an instance of the adverse effect that Smeathman's conduct was having on his reputation, he added that Fothergill had proposed at a recent meeting of the subscribers that an additional payment of £50 should be made by each subscriber but the suggestion had been turned down until some return on the original payment should be forthcoming.

Another of Smeathman's complaints was the lack of sufficient assistance. His request for help was considered by the subscribers, and Fothergill offered to pay the expenses of a young Swede who was prepared to go to Africa, but the matter fell through, and Drury put forward the claims of a young man who wished to become an entomologist and who was prepared to go to Africa for 3 years at a salary of £20 per annum with all found. When interviewed by Smeathman's brother, however, this candidate was found to be unsuitable. Finally it was proposed to send a certain "Young Allen," but this came to nothing since Smeathman had left Africa before negotiations were completed. So far as I can gather from the correspondence, Smeathman must have had an assistant, named David Hill, for in his letter of 28.xi.1774 Drury reports that he had paid Mrs. Hill 5 guineas and given her a bill for £20 at 2 months on account of wages due to her son of that name, and a year later Drury wrote to Smeathman that he had met drafts of £30 and £20 in favour of Hill and reminding him of the payments he had himself made to the same person. Judging by the proposed wages offered to "Young Allen," this total payment of £76 5s. for wages must have covered a considerable period and a remark by Drury in his last letter to Smeathman that Hill had said that Smeathman still had a collection of insects in Jamaica suggests that Hill had remained in Africa until Smeathman's departure and possibly returned to England with the collections.

In due course the first consignment of specimens reached the subscribers. It was a box of insects acknowledged by Drury, nearly 2 years after Smeathman's departure, on 7.vi.1773. The contents of the box were valued by Messrs. Hudson, Church and Yeats at 80 guineas and after division the subscribers balloted for the insects. Smeathman soon objected that the valuation was too

low but Drury defended it in his letter of 30.i.1774. Apparently some of the specimens had travelled badly, for Drury complained of the condition of many on their arrival and added: "... I charge you never use any of those cussed small pins again.", for, he adds, the effect of the salt water on the pins had been catastrophic!

The next consignment comprised 2 boxes, also of insects it seems, and with these Smeathman included his own valuation of £200, which Drury felt was much too high. Moreover, Drury complained, the collection contained a high percentage of duplicates of species already sent in the first despatch.

The third consignment was acknowledged by Drury in January 1774 and was valued at £100, excluding the duplicates, some of which Drury had sold for £28. A difference of opinion seems to have arisen over these duplicates, for Smeathman appears to have regarded them as still his property if the subscribers did not wish to retain them and he asked for their return. Eventually the subscribers decided that all duplicates were their property and ordered them to be sold. This consignment realised 84 guineas as Drury reported in his letter on 1.ii.1774.

The final collection arrived in 1775 but in the meantime on 26.v.1774 Drury had had cause to complain bitterly to Smeathman that Fothergill was intensely annoyed over a letter he had received from Linnaeus reporting that he had received a fine collection of plants from Smeathman. All the plants were new, and Linnaeus asked that further specimens should be sent him. It is not surprising that Fothergill's remarks are stated to have been very much to the point, for it should be remembered that Fothergill was passionately interested in plants and seeds and had so far received none of these from Smeathman.

However, it appears that Fothergill's desires were satisfied by the tremendous collection Smeathman eventually sent home, for the arrival of the collection created a major problem for Drury and he was forced to hire a room in Essex House at a guinea a week to house it, so great was its bulk. His letter is dated 22.xi.1775 and addressed: "To Mr Henry Smeathman at the Honble Peter Campbell's Mount Pleasant Tobago or at Wm Moores junr Esq. Bridge Town Barbadoes." It is evident from the contents that Smeathman had left Africa and despatched the whole of his accumulated collections to England. Drury was alarmed at their size. "My house could not possibly contain one half the things when taken out of their packages," he wrote, and as for the unpacking of the plants alone "the labour appears to me [to] be immense & I dare say would take any single person 2 month to perform it, let the application be as close as it may." Drury complained at length that the collection should have been sent in smaller consignments from time to time and not accumulated as it had been. Moreover, it is apparent that the subscribers were in no very good temper with the results of the expedition for, Drury continued, "You say 'you hope yr Patrons will advance what will be necessary' I do not know what that may be, but this I know that if nobody advances any more money for you than them I believe your affairs will not be in a very flourishing condition.—I have been informed that they are not extraordinary well satisfied with what you have sent.—The Duchess has been continually teasing me about *Shells*.—Mr. Tunstall has often spoke to me about *Birds*—& Mr Banks tells me that you have wrote him an angry letter for not directing you how to collect Plants, when he could not have been certain he says you would have collected any, if he had given you those directions having not seen any produce of your labour that way.—Dr Fothergill says little but much to ye purpose, but blames you much for not sending during the 4 years one single box of Seeds. In short I believe if ye Drs. Scheme proves abortive, you will never set foot on the

African Shore again on any expedition for natural History." Hardly an encouraging finale to some 4 years of grave discomfort and endeavour under the African sun!

But this was not all the bad news, for it appears that Smeathman had despatched some termite nests to England and Drury wrote: "However hard and compact the Nests of the Bug a Bug [termite] may be in Africa they are now so fragile and tender that every one of them broke to pieces—there is not one whole piece and they all moulder to dust with amazing rapidity—I fear the freight of them amounts to more money (considerably) than all the whole bulk of them will fetch." It was a sad happening, for in those early days who knows but that a termite's nest might have been an object of great value! The news of the remainder of the collection was better: "The insects are in fair condition in general; all the shells appear to me to be *dead* but I do not understand that branch—." Great surprise is expressed by Drury that so few birds were sent and those sent were seemingly valueless, for John Latham valued them at less than five shillings! Smeathman had made an estimate of £200 for the insects but, as usual, Drury thought this far too high and gave his opinion that a figure nearer one-half that sum would more truly represent their value. Finally there is evidence that the secret trade in duplicates was still proceeding, for Drury wrote: "I shall also observe your directions about the Duplicates, not a Soul has seen ym beside myself nor shall any one."

And there the correspondence ended. The final disposition of the great collection is not recorded. I suppose it was duly divided among the subscribers and the episode of the African expedition completed. There remains to relate a few matters of more general interest in the letters such as Drury's advice to search for gold. "Minerals or maybe mines may be found, where does all the Gold come from that is brought to Europe? sure there must be some source or store of it from whence it is washed down into rivers and is this store never to be discovered? . . . how I should rejoyce if it was at ye last hour of my life to know you had found it out. I verily believe it would drive the grim Tyrant away and stop ye course of nature for a few minutes." Perhaps Drury was of a mercenary nature, for in another letter he complained of the hard times and the deadness of trade. "Oh damned Avarice," he wrote in 1773, "what a large portion of ease & comfort have I parted with? and entirely for the sake of a son, who perhaps by and by it may be of no service to . . . To speak the truth, that practice wch I observed early in life made me a Misanthropist." But he controlled his feelings and continued: "I have lately heard that Emeralds are frequently found there [in Africa]. If you therefore find any green Stones pray send them to me." and in a later letter he asked for any stones that are "quite black and hard preserve them with great care—they must be blacker than flints and without any milky spots on them but of a regular even colour." But poor Smeathman found no diamonds in Sierra Leone!

That, then, is the story of the expedition to Africa. It is a story without an end, for I have not discovered when Smeathman reached England again. That he stayed some years in the West Indies is proved by a letter from Drury to Gerald Tiese, who had claimed payment for a debt due from Smeathman. Drury replied that he held no funds on Smeathman's account and added that he had stayed in the West Indies much longer than was expected "or is good for his reputation." That was written on 28.v.1777.

The remainder of Smeathman's story is briefly told, since little is known concerning it. This is the more unfortunate, since that little is sufficient to whet an appetite which at present I have no means of satisfying.

In Fox's *Fothergill*, 1919, page 213, it is recorded that "He [Fothergill] had, too, a cabinet of insects; on these he corresponded with Seymer: it contained many specimens from America. In order to investigate the natural history and products of Spain and the West Coast of Africa, Henry Smeathman was engaged in 1771 by Fothergill, acting in co-operation with Drury, Banks and Marmaduke Tunstall, to spend three years in those countries. Armed with Fothergill's instructions, Smeathman was enabled to survive the malignant fevers and fluxes of the Sierra Leone coast, although his companion in travel died. Large numbers of new plants were sent home by him to Banks—a beautiful passion-flower is named *Smeathmannia*—and many remarkable insects came to Fothergill. Smeathman's chief work was to write the first detailed account of the Termites or so-called white ants of Guinea, their habits, buildings and mode of propagation. It was a "traveller's tale" of no little wonder, for the ants dwelt in cities with towers; but the Royal Society gave it due hearing, and its truth has been established. The explorer allied himself by marriage with the native chiefs, and afterwards wandered to the West Indies, staying out long years beyond the time appointed; but his patron showed him much patience and liberality." Apparently the instructions given by Fothergill for the treatment of "fever" was with "an emetic, followed by cinchona in large quantities, given between the fits, and Epsom salts if necessary. In fluxes fowlbroth was to be taken largely, and after the bile had been freely discharged, anodynes."

It is a matter of regret that further details of Smeathman's alliance with the native chiefs are wanting and I am unable to find any word on this subject in addition to that quoted.

As I have stated already, Fothergill was a Quaker and medical man, and at his death John Coakley Lettsom succeeded to his practice. Lettsom was likewise a Quaker and also interested in natural history. According to Abraham (1933, *Lettsom his life, times, friends and descendants*: 236) Smeathman corresponded with Lettsom on the subject of balloons: "This . . . St Fond . . . was a man of many interests, for in the previous year he had written a treatise on balloons. He was evidently on friendly terms with Henry Smeathman, who at that time was writing from Paris to Lettsom on the same subject. Smeathman's name is now forgotten; but he actually discovered in this year the principle on which aeroplanes work, and had designed a machine to test his theories which had the approval of Franklin. Had petrol been known in his time, and had Smeathman lived, the whole of modern aeroplane construction might have been antedated by 100 years." I am of the opinion, however, that Smeathman was writing to Lettsom on a different matter, and Abraham's reference on page 57 of the same work is more probably concerned with the matters of common interest to Lettsom and Smeathman: namely, Smeathman's plan to settle free negroes in Sierra Leone, which proved a disastrous failure.

Some further information is to be found in Fox's *Fothergill* page 214: "A copy of Smeathman's paper on the Termites, inscribed in his hand to Lettsom, is in the British Museum: at the end is a printed letter, in which he offers to teach elocution and polite literature in London; also a prospectus in French of a large work on his travels in Africa and America to be brought out by subscription—doubtless never published. In 1783 he was in Paris, his affairs being involved, and was occupied on the prevailing subject of balloons. He projected an aerostatic machine, and saw clearly that it must be heavier than air in order to obtain due control. He showed it to Franklin, who approved the principle. The Medical Society of London elected him a Corresponding Member in 1784. In 1786 Smeathman had another scheme, for forming a settlement

of Poor Blacks near Sierra Leone, in which he was supported by Jonas Hanway, Samuel Hoare and others, with a promise of assistance from the Commissioners of the Treasury. But he died before the party could set out; another leader, Irvine, was found, with surgeons, chaplain and others, Lettsom interesting himself in the venture. About 500 free negroes of both sexes, besides whites, set sail, but the expedition was doomed to failure from the outset: they quarrelled and fought on the passage: sickness played havoc among them: the leaders died, and soon most of the party perished in the tract of land they had purchased from "King Tom". The white ants ate up the seeds and stores."

And so I come to the end of the story. For over 150 years Smeathman has been little known to entomologists and now he is stated to be forgotten even in name! In Entomology his name will live if only by reason of his classic paper on the Termites. I think it will also continue to be known in those circles interested in the humanitarian principles for which our forefathers struggled so hard in their attempts to alleviate the lot of the slaves in the Sugar Plantations of the West Indies so long ago.

LARVAE OF THE BRITISH TRICHOPTERA. 1

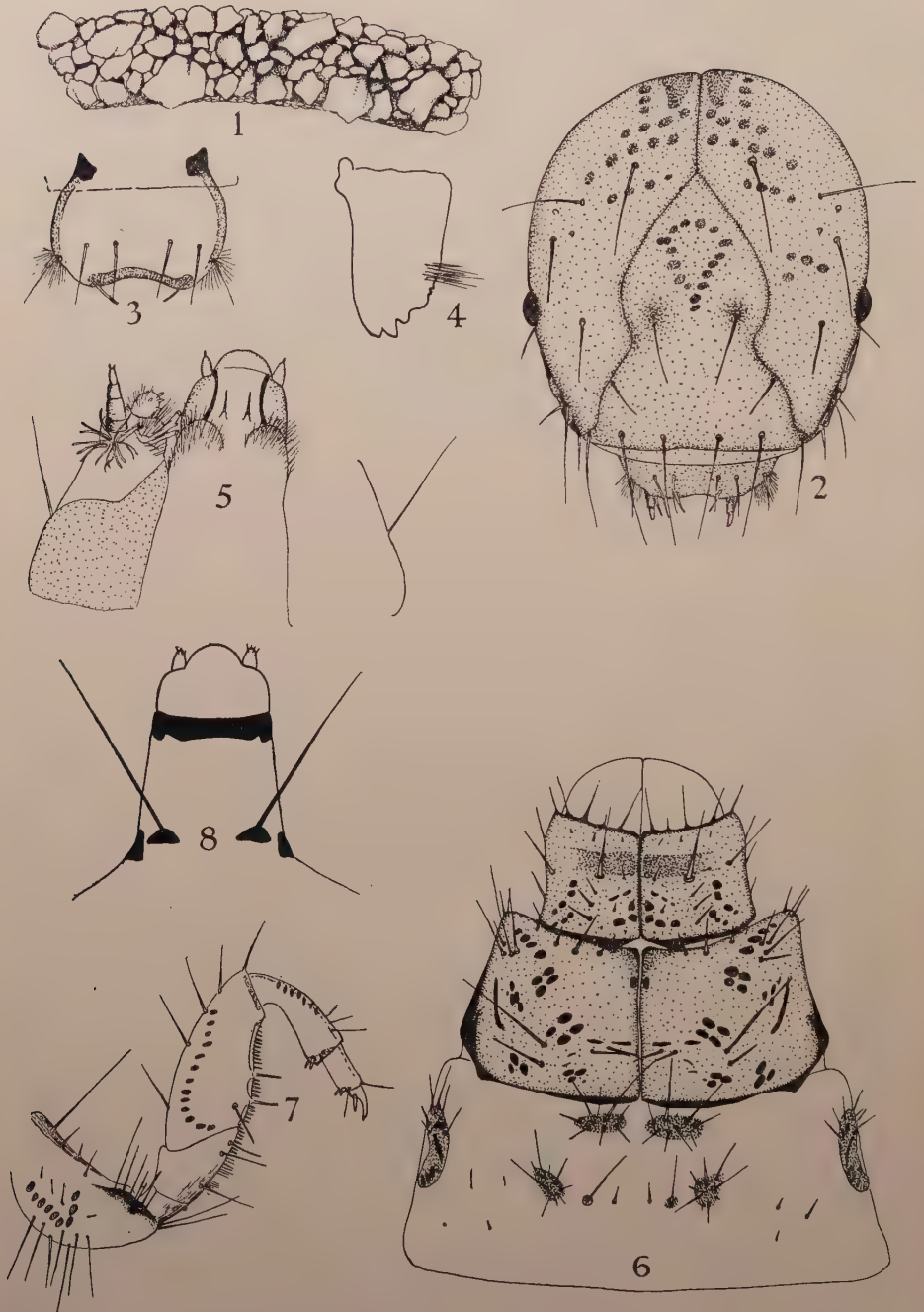
By N. E. HICKIN, Ph.D., F.R.E.S.

Stenophyllax stellatus Curtis (LIMNOPHILIDAE).

DESCRIBED from larvae collected from Dowles, Worcestershire, some of which were reared to maturity and also compared with larvae collected from the Lake District (Grizedale Tarn).

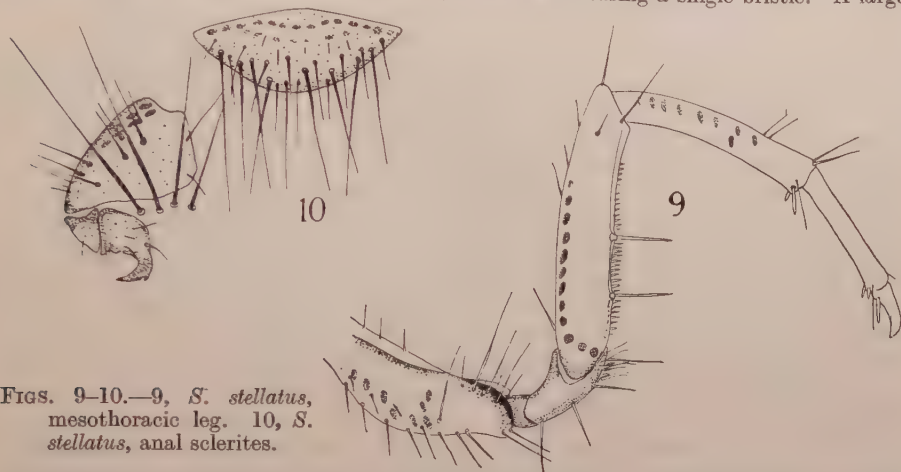
In Dowles Brook (a fast-running stream) it is most abundant, sheltering in small groups under the slabs of Bunter sandstone which form the bed of the stream. There is no phanerogamic vegetation in this water.

The *Case* is about 20–22 mm. in length and is slightly curved longitudinally with slight dorso-ventral flattening. It is composed of small flattened pebbles and fragments of stone and large sand grains (fig. 1). Smaller pebbles and sand grains tend to be placed on the ventral surface of the case and the larger pieces of stone are placed at the sides near the ventral surface. There is a small opening at the posterior end, and, previous to pupation, the case is attached by the anterior end to the underside of a large stone. The *larva* is uniformly cylindrical with the head hypognathous (fig. 2). *Head*: the clypeus has a kite-shaped pattern of dark spots at the aboral end with a pair of large bristles at the base of the pattern. At the oral margin of the clypeus there is a row of six bristles, the outermost pair of bristles are just embraced by the outcurving of the clypeus. A pair of smaller bristles are situated between the latter and the former pair of bristles. The mouth-parts are very small compared with the size of the larva. The labrum (fig. 3) is strongly indented, the indentation being heavily sclerotised. A small blunt spine is situated at each end of the sclerotised part. A row of six bristles is located transversely in the middle of the exposed part of the labrum. The mandibles, which are slightly asymmetrical (fig. 4), are broad and heavily chitinated. There are four large teeth and two much smaller teeth. A tuft of hair is situated near the small teeth and directed inwards. The maxillae and labium (fig. 5) are extremely small. The maxillary palp is four-segmented and on the maxilla are several tufts of hairs and modified setae which are probably sense organs. On the oral side of the labium is a pair of spines, set on small protuberances, whilst on the ventral surface of the labium there is a pair of large spines as long as the labium itself, and projecting from a pair of sclerotised parts near the base (fig. 8). *Thorax*: the terga



FIGS. 1-8.—*Stenophyllax stellatus*, 1, case. 2, head. 3, labrum. 4, right mandible. 5, labium and maxilla. 6, head and thorax. 7, prothoracic leg. 8, ventral view of labium.

of pro- and mesothorax are completely sclerotised whilst the metathoracic tergum is only partially sclerotised (fig. 6). A dark transverse band runs across the prothoracic tergum slightly nearer the anterior than the posterior margin. In dorsal view three patches of dark spots are visible, one medium and two lateral. All these are posterior to the dark transverse band. The mesothorax is almost half as wide again as the prothorax. Groups of dark spots are arranged obliquely running from the middle of the posterior margin to the lateral vertex of the anterior margin. Two isolated spots are situated one on each side of the median line close to the anterior margin. The posterior lateral vertices are heavily sclerotised. The metathorax is slightly wider than the mesothorax. It is unsclerotised except for isolated patches. On the dorsal surface two patches lie anteriorly near the median line. A number of stout bristles emerge from each patch. Posterior to the latter are two more patches of approximately similar size but lying farther away from the median line. These patches also are furnished with bristles. In between the latter patches is a pair of very small sclerotised patches each bearing a single bristle. A larger



FIGS. 9-10.—9, *S. stellatus*, mesothoracic leg. 10, *S. stellatus*, anal sclerites.

sclerotised patch occupies the pleural regions of the segment. These patches bear a bunch of bristles anteriorly and in addition are marked by a short series of dark spots. A dark spot in the central part of the patch is elongated. *Legs*: the prothoracic legs (fig. 7) are approximately two-thirds the length of the mesothoracic legs (fig. 9), but are considerably broader. Meso- and metathoracic legs are approximately equal in length but mesothoracic legs are slightly broader. The most heavily sclerotised segment is the trochanter in each case. In all legs there are two distal spurs on the two segments of the tarsus and two marginal spurs on the tibia. A spine is present at the base of each claw. *Abdomen*: hooks on first abdominal segment are absent. Gills are present, but their position and numbers are variable, and thus have little value in identification. The abdominal claws are closely opposed to the last segment and are two-segmented. Four very stout bristles are situated between the claw and the lateral sclerite on each side (fig. 10). The superanal plate has the anterior margin of greater radius of curvature than the posterior margin. Along the latter there is a series of about nine large bristles and some smaller ones. Along the anterior margin there is a row of faintly marked spots indented in the centre and with a fainter and smaller row behind (fig. 10).

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 —, 1909, *Süsswasserfauna Deutschlands* 5, 6 : 267.

LARVAE OF THE BRITISH TRICHOPTERA. 2

By N. E. HICKIN, Ph.D., F.R.E.S.

Trienodes bicolor Curtis (LEPTOCERIDAE).

THE larva of this species is very easily distinguished both morphologically and on account of its characteristic habit of swimming. It is able to propel itself with its case through the water by means of rapid movements of its metathoracic legs, which are especially adapted for the purpose. The following description of the larva is based on material collected at Clay Pond, Wray Castle, Windermere, and compared with specimens from a pool in Broadmoor Wood, Rubery, Worcestershire. Both these pools are still water and contain much phanerogamic vegetation.

Case (fig. 1): the case is long and tapering. It is composed of regularly shaped pieces of leaf or small whole leaves. All the fragments are arranged in a spiral whorl, the whole case being strongly reminiscent of a miniature *Phryganea grandis* case. Size up to 35.0 mm. in length, 2.0-2.5 mm. in width. *Larva*: the head is almost prognathous. A prominent feature of the larva is the length of the metathoracic "swimming" legs and their hair fringes. Size of larva 12.0-13.0 mm. long, 1.5 mm. broad. *Head* (fig. 2): very bright golden yellow marked with prominent dark spots. Two dark bands run longitudinally along the clypeus in which some of the dark spots are confluent. The dark bands are united posteriorly by a transverse band of four dark spots. A larger but similar shaped pair of dark bands runs parallel to the first-mentioned bands just outside the clypeus. Other patches of dark spots occur on the genae, and four large spots lie between the four transverse spots on the clypeus and the larger pair of dark bands where they run together. The antennae are two-segmented. The proximal segment is bulbous, whilst the distal segment is long, slightly incurved and surmounted with a strong bristle (fig. 8). *Mouth-parts*: the mandibles (fig. 3) are asymmetrical. The maxillary palps are 3-segmented, whilst the ligula is broad. The single-segmented labial palps are very small. All the mouth-parts are very small in comparison with the size of the larva. The labrum is notched, the concavity being sclerotised (fig. 4). *Thorax* (fig. 2): pro- and mesothorax strongly sclerotised, deep golden yellow in colour and marked with prominent dark spots. Metathorax unsclerotised but with long dark coxal sclerites with which the swimming legs articulate. The prothorax has patches of dark spots situated along the posterior margin. Several stout bristles are placed on the anterior angles of the segment. In the mesothorax a short row of dark spots lies along the anterior margin, together with a row of about six long stout bristles. In addition a transverse row of spots lies across the middle of the segment and divides into two a little way from the median line. *Legs*: prothoracic legs short and broad. Femur has three marginal spines and the trochanter four. Tarsal segments short, proximal segment very broad (fig. 5). Metathoracic legs long with two rows of hairs running along whole length (fig. 6). *Abdomen*: dorsal and lateral hooks present on first segment of the abdomen. Single gills are usually present on the dorso-lateral and ventro-lateral surfaces of segments II to VII on each side but those on the last two segments may be absent. On the dorsal surface of segment IX there is a dark-coloured heart-shaped anal sclerite. It does not bear bristles (fig. 7).

Larvae of *Trienodes conspersa* Rambur, the only other species in the genus on the British list, and the only species with which *T. bicolor* could be confused, have not yet been collected by me. Ulmer states, however, that the head is brownish without dark spots and the larva is also larger than *T. bicolor*.

PROC. R. ENT. SOC. LOND. (A) 17. PTS. 1-3. (MARCH 1942.)



FIGS. 1-8.—1, *Triaenodes bicolor*, larva in case. 2, *T. bicolor*, head and thorax. 3, *T. bicolor*, mandible. 4, *T. bicolor*, labrum. 5, *T. bicolor*, prothoracic leg. 6, *T. bicolor*, metathoracic leg. 7, *T. bicolor*, anal segments. 8, *T. bicolor*, antenna.

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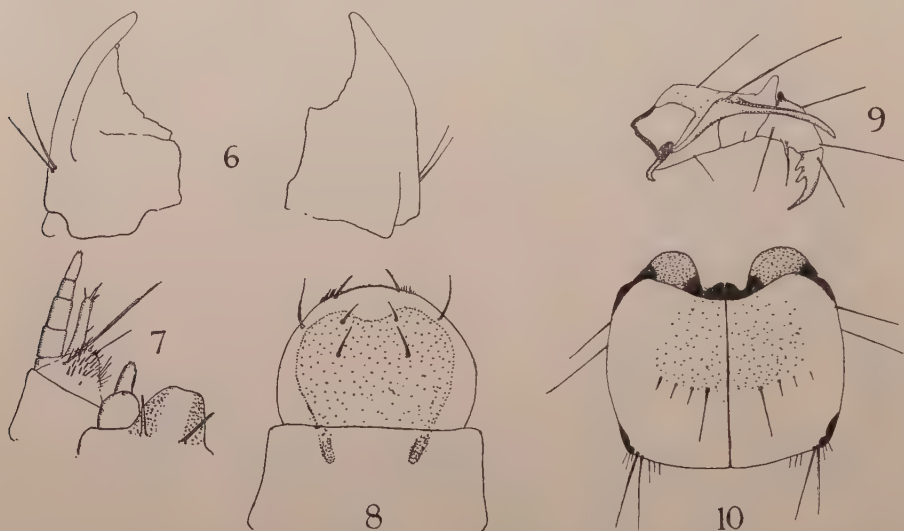
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 —, 1909, *Süsswasserfauna Deutschlands* 5, 6 : 249.

LARVAE OF THE BRITISH TRICHOPTERA. 3

By N. E. HICKIN, Ph.D., F.R.E.S.

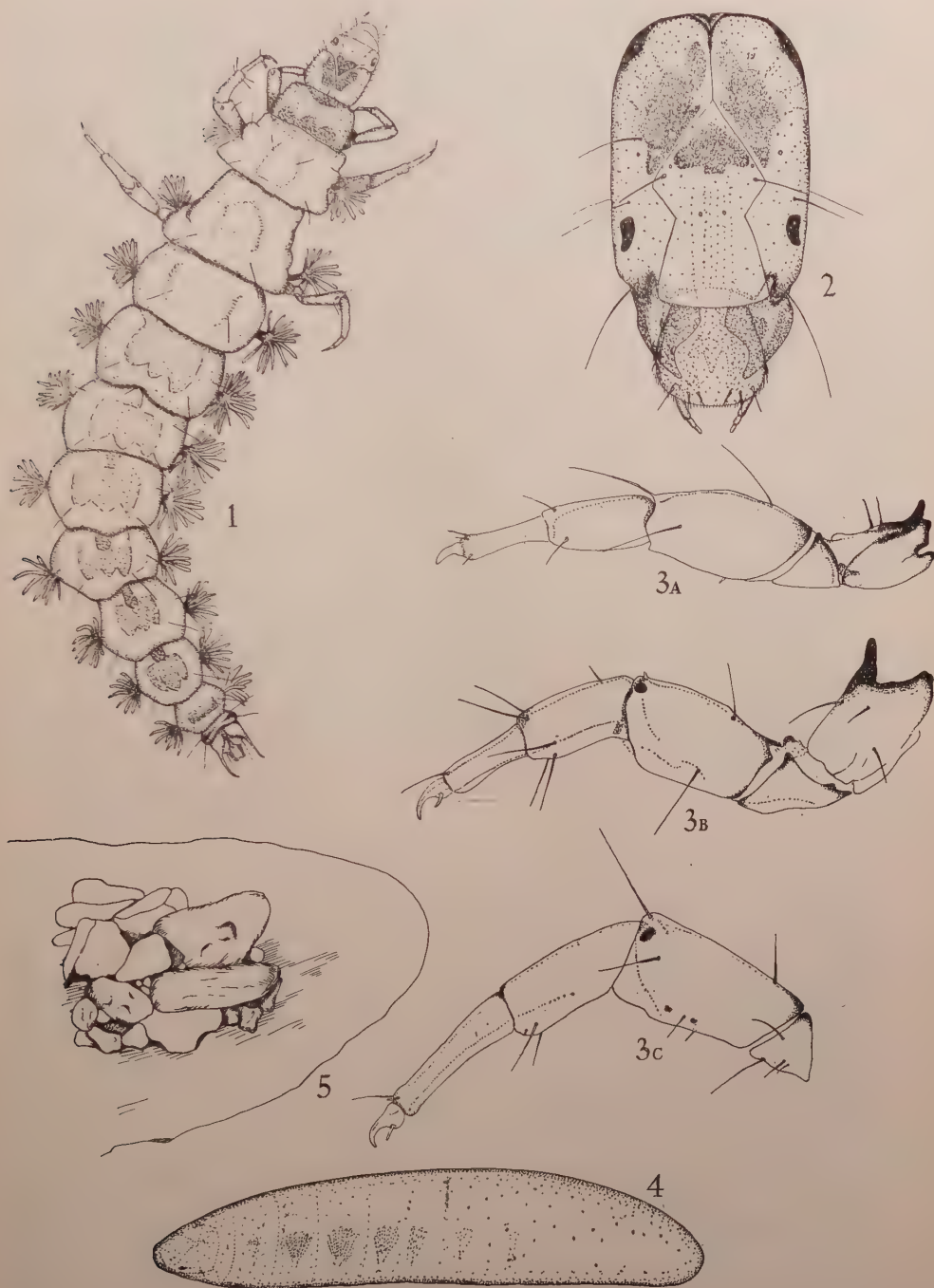
Rhyacophila dorsalis Curtis (RHYACOPHILIDAE).

THIS species is commonly found crawling about on the under-surface of stones at the bottom of quickly running streams and brooks. The following description was made from specimens taken from Dowles Brook, Bewdley, and compared with specimens from Cranham, Gloucestershire.



FIGS. 6-10.—6, *R. dorsalis*, mandibles. 7, *R. dorsalis*, maxilla and labium. 8, *R. dorsalis*, labrum. 9, *R. dorsalis*, anal claw. 10, *R. dorsalis*, prothorax.

Larva (fig. 1): campodeiform. Head procentrous. Only the prothorax is sclerotised. Gills present. The head and prothorax is a light creamy yellow, the remainder of the thorax and the abdomen varies from light green to purplish shades. *Head* (fig. 2): very long with the genae running parallel for a considerable distance. The oral part of the clypeus is attenuated. At the aboral end of the clypeus is an inverted heart-shaped dark marking occupying almost all of the area. A dark patch also occurs on each of the genae near the suture. *Mandibles* (fig. 6): asymmetrical. Each bears a pair of bristles, but the left has a prominent ridge a short distance from the outer border. *Labrum* (fig. 8): almost hemispherical. The central part is sclerotised, and shows a median notch opposite the anterior margin. Apart from two pairs of bristles situated on the margin there are two other pairs in two transverse groups. The maxillary palp has the appearance of being five-segmented, but the proximal segment is very short. A one-segmented palpiform mala is present. *Labium* (fig. 7): very small. *Thorax*: only the prothorax is sclerotised. The posterior and lateral margins of the prothorax (fig. 10) are convex. The anterior margin is concave with two large outer and two small inner articulating facets which are heavily sclerotised and dark in colour. The outer angles between the posterior and lateral margins of the prothorax, from which two large and several smaller bristles arise, are also more heavily sclerotised and dark in colour. A group of eight bristles form a transverse band across the centre of the prothorax and from it



FIGS. 1-5.—1, *Rhyacophila dorsalis*, larva. 2, *R. dorsalis*, head. 3, *R. dorsalis*, A prothoracic leg, B mesothoracic leg, C metathoracic leg. 4, *R. dorsalis*, cocoon. 5, *R. dorsalis*, pupal case.

stretching to the anterior margin of the prothorax is a dark patch. *Legs* (fig. 3): comparatively short and stumpy. Approximately all the same size. Tarsal claws small with a small spur in the meso- and metathoracic legs. Trochanter is one-segmented. No spines on ventral margin of tarsus and tibia. Three bristles occur on ventral surface distal end of proximal tarsal segment in meso- and metathoracic legs. A dark spot occurs on each side of the tibia at the distal end near the dorsal surface in meso- and metathoracic legs. A tuft of gills occurs at the bases of meso- and metathoracic legs. *Abdomen*: the width of the abdominal segments decreases progressively from anterior to the posterior end. Each of the first eight segments bears a large filamentous tuft of gills and four bristles on the dorsal surface. Each segment is strongly convex in dorsal and lateral regions. The ninth segment has no gills and has a dark heavily sclerotised transverse band in a median position. The anal hooks (fig. 9) are two-segmented and long. The proximal segment bears a long bristle and the distal segment several smaller bristles and spines. Auxiliary hooks are present external to the main hooks but are one-segmented. *Pupation*: just before pupation the larva constructs a chamber of large fragments of stone which it lines with silk (fig. 5). A tough chestnut-coloured pupal case or cocoon (fig. 4) is formed in which the larva pupates.

REFERENCE.

MOSELY, M. E., 1939, *British Caddis Flies*: 238.

LARVAE OF THE BRITISH TRICHOPTERA. 4

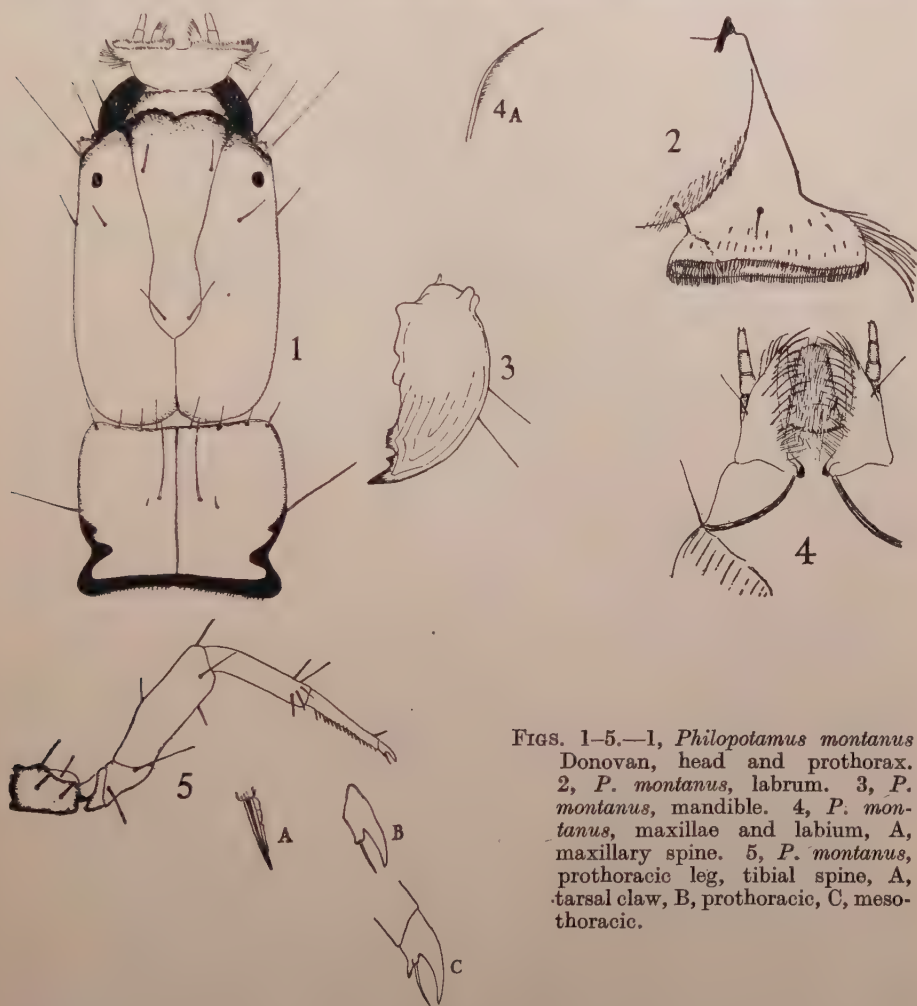
By N. E. HICKIN, Ph.D., F.R.E.S.

Philopotamus montanus Donovan (PHILOPOTAMIDAE).

THE present description is taken from specimens collected in Lily bed stream running into the west side of Lake Windermere. This stream cascades over a bed of rocks and is very well aerated. The larva constructs silken nets and tunnels on the underside of the pieces of rock in the torrential part of the stream.

The larva is campodeiform and has the head and prothorax a light chestnut-brown colour. Only the prothorax is sclerotised. The abdomen is white and lateral abdominal gills are absent. In size the larvae go up to 22.0 mm. long and 2.6 mm. broad, but maximum size is variable. *Head*: the head is long, the genae running parallel for some considerable distance. It is prognathous. There are no dark spots, the colour being a uniform light chestnut brown, except at the anterior margins of genae and clypeus, which are more heavily sclerotised and very much darker in colour (almost black). The anterior part of the clypeus is attenuate (fig. 1). The antennae are rudimentary. *Mouth-parts*: the labrum is quite distinctive (fig. 2). It is unsclerotised and extends a considerable distance forwards. Right and left lobes form brushes with straight anterior margins which are transverse. The brushes consist of several rows of small hairs with a bunch of longer hairs at the sides curling inwards. The mandibles have the outer margin uniformly convex with two projecting bristles arising at about the middle. The outer tooth is much larger than the others. The mandible is more than twice as long as broad (fig. 3). The maxillae have four-segmented palps with a bristle towards the base (fig. 4). The maxillae are beset with a number of thin sickle-shaped bristles all bearing secondary hairs (fig. 4, A). All these bristles are directed inwards towards the labium. The latter is very small, rather hairy, and the labial palps are much reduced. *Thorax*: only the prothorax is sclerotised. It is light chestnut brown in colour, except the posterior margin, which is more heavily sclerotised and is much darker in colour. A row of bristles is set along the anterior margin of the prothorax and another row runs transversely across the centre. *Legs*: the tarsal claws of all the legs

have a spine set upon a protuberance. The protuberance is elongated beyond the base of the spine, this being shown better in the meso- and metathoracic legs than in the prothoracic. The tarsal segment is fringed with small spines along its entire length in the prothoracic leg (fig. 5), but these are restricted to the distal end of the segment in the meso- and metathoracic legs. A small group of spines on the distal end of the tibia are somewhat flattened. *Abdomen*: the abdomen, which is white in colour, is devoid of gills except a small group just dorsal to the anus. These are apparently eversible. The abdominal claws are two-segmented, the proximal segment being slightly concave anteriorly and beset with three spines. The claw has a small group of hairs on the convex side.



FIGS. 1-5.—1, *Philopotamus montanus* Donovan, head and prothorax. 2, *P. montanus*, labrum. 3, *P. montanus*, mandible. 4, *P. montanus*, maxillae and labium, A, maxillary spine. 5, *P. montanus*, prothoracic leg, tibial spine, A, tarsal claw, B, prothoracic, C, mesothoracic.

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A NOTE ON *TIMULLA* (*TIMULLA*) *ERIPHYLE* MICKEL (HYM.,
MUTILLIDAE), A PARASITE OF *TACHYSPEX BLATTICIDUS*
F. X. WILLIAMS (HYM., LARRIDAE), FROM TRINIDAD, B.W.I.

By E. McC. CALLAN, Ph.D., F.R.E.S.

(Entomology Department, Imperial College of Tropical Agriculture, Trinidad, B.W.I.)

THE host relations of the neotropical MUTILLIDAE appear to be little known. Mickel (1938 : 536), referring to the genus *Timulla*, states that "nothing is known regarding the biology or the hosts of any of the neotropical species." This is the more remarkable in that Mickel refers to no fewer than 175 species of this genus from the neotropical region.

The Mutillid, *Timulla* (*Timulla*) *eriphyla* Mickel, was reared as a parasite of the Larrid, *Tachyspex blatticus* F. X. Williams (1941), at St. Augustine, Trinidad, B.W.I. This record is of interest, therefore, as a first contribution towards a knowledge of the biology and host relations of the neotropical species of *Timulla*.

The LARRIDAE include burrowing wasps, the majority of which provision their nests with Orthoptera, although some are known to prey on Hemiptera and Psocoptera. *Tachyspex blatticus* is a small black species, nesting gregariously in sandy places, and preying on cockroaches, with which it provisions its nests.

The cockroach prey is captured in the adult stage, and Mr. J. A. G. Rehn, who has very kindly examined specimens, informs me (1940, *in litt.*) that it is a *Chorisoneura* sp. Mr. Rehn states that the genus *Chorisoneura* includes a large number of species, separated often by genitalic and venational characters, and unless the material is in perfect condition, its determination is almost or quite impossible. Unfortunately the condition of the cockroach prey was such that it was impossible to make a specific determination.

Mickel (1938) described the female of *Timulla eriphyla* from French Guiana with paratypes from French Guiana; Trinidad, B.W.I.; Venezuela and Colombia. The male is unknown.

In July 1938, *Tachyspex blatticus* was found nesting gregariously at St. Augustine, Trinidad, B.W.I., and a number of cocoons were removed from the nests. Larvae in various stages of development were also found feeding on their cockroach prey. Some of these completed their development and pupated, wasps eventually emerging from the cocoons. From cocoons removed from nests, three females of *T. eriphyla* emerged on 4, 6 and 9 August 1938 and a number of males and females of *T. blatticus* on 15 August 1938.

One female of *T. eriphyla* has been deposited in the collection of the University of Minnesota and two females in the collection of the Imperial College of Tropical Agriculture, Trinidad, B.W.I. Williams (1941) refers to the museums and collections in which specimens of *T. blatticus* have been deposited.

I wish to express my indebtedness to Professor C. E. Mickel of the University of Minnesota for the determination of *Timulla eriphyla*, Mr. J. A. G. Rehn of the Academy of Natural Sciences of Philadelphia for the determination of *Chorisoneura* sp., and Dr. F. X. Williams of the Hawaiian Sugar Planters' Association Experiment Station, Honolulu, Hawaii, who kindly undertook to describe *Tachyspex blatticus* as a new species.

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WILLIAMS, F. X., 1941, An apparently undescribed *Tachyspex* (Hymenoptera, LARRIDAE) from Trinidad, B.W.I. *Proc. R. ent. Soc. Lond.* (B) **10** : 197-199.
PROC. R. ENT. SOC. LOND. (A) **17**. PTS. 1-3. (MARCH 1942)

THE RELATIVE SIZES OF DIFFERENT PARTS IN BEETLES OF
THE GENUS *LAEMOPHLOEUS* (COLEOPT.: CUCUJIDAE)

By J. A. REID, B.Sc., A.R.C.S., F.R.E.S.

THE problem of the differential growth-rates of various parts of animals has been discussed by Huxley (1932). The differential growth-rates of the early stages result, of course, in different sizes of parts in the adult. To prove that an organ exhibits differential or relative growth, it is only necessary to show that its length or weight, or whatever property is measured, is greater (or smaller) with respect to the rest, or to some other part of the body, in large specimens than in small (see table II, column A/E). The degree of relative (differential) growth is measured by k which is the constant of differential growth ratio. Huxley (1932) gives the following formula, $y = bx^k$, where y is the differentially growing organ and x the standard dimension. If the formula is obeyed then, when the logarithms of the values of y and x are plotted, a straight line should be obtained; the tangent of the angle this line makes with the x axis $= k$. If there is no differential growth then the slope of the line is 45° and the value of $k = 1$; if there is positive differential growth, the value of k is greater than unity. If differential growth is negative; i.e., the differentially growing organ becomes smaller relative to the standard dimension as the animal becomes larger, then k is less than unity.

For the purpose of making measurements, most of the *Laemophloeus* were taken from insectary cultures and were gummed on microscope slides with the antennae stretched out parallel to the long axis of the body. The measurements were made with a micrometer attached to a binocular microscope, and the length of the elytra was chosen as the standard dimension indicating the size of a specimen.

Table I records the observed extremes of body length, antennal length,

TABLE I.

Observed range of body length, antennal length, and the ratio antennal length/body length.

Species of <i>Laemophloeus</i>		Body length, mm.	Antennal length, mm.	Ratio
<i>minutus</i>	♂	1.38-1.91	0.84-1.65	0.53-0.86
	♀	1.40-1.92	0.54-0.96	0.50-0.52
<i>turcicus</i>	♂	1.62-2.17	0.91-1.77	0.69-0.80
	♀	1.50-2.10	0.77-1.14	0.50-0.54
<i>ferrugineus</i>	♂	1.78-2.25	0.76-1.14	0.42-0.55
	♀	1.70-2.34	0.70-0.93	0.40-0.42
Sp. near to <i>ater</i> ¹	1 ♂	2.36	0.87	0.37
	3 ♀	1.86-2.28	0.75-0.84	0.36-0.40

¹ For the taxonomic account of these species see p. 29-33.

and the ratio antennal length/body length. The table serves to display the relative sizes of the species and the differences in the relative lengths of the antennae between the species and between the sexes. Only a few measure-

ments of total body length were made, so that the ranges recorded for the body length and the ratio are tentative only. Contrary to the statement by Richards and Herford (1930: 370) in their key, the ratio shows that the antennae of male *minutus* and *turcicus* do not attain a length as great as or greater than that of the body.

Differential growth in L. turcicus Grouvelle.

Males. In a series of 58 specimens measurements were made of the length of the elytra, antennae, and last three segments of the antennae. The specimens were divided into six groups according to the length of the elytra, and table II shows the mean values of the length of the elytra, antennae, etc., in these groups. The figures in *italics* are the values of *C*, the coefficient of variability, which is the standard deviation expressed as a percentage of the

TABLE II.

Grouped data. Measurements in millimetres. The figures in *italics* are the values of *C*, the coefficient of variability.

Elytra length groups	No. of specimens per group	E. Mean elytra lengths	A. Mean antennal lengths	A/E	Means of last 3 antennal segments	Means of remainder of antennae
58 male <i>turcicus</i> .						
0.87-0.92	2	0.89 <i>11.94</i>	0.99 <i>10.29</i>	1.102 <i>11.15</i>	0.34 <i>8.93</i>	0.65 <i>11.14</i>
0.93-0.98	4	0.97 <i>4.67</i>	1.12 <i>11.20</i>	1.154 <i>10.30</i>	0.38 <i>15.15</i>	0.74 <i>18.30</i>
0.99-1.04	17	1.02 <i>3.50</i>	1.27 <i>8.69</i>	1.249 <i>6.85</i>	0.43 <i>10.82</i>	0.84 <i>9.52</i>
1.05-1.10	18	1.08 <i>2.28</i>	1.43 <i>9.87</i>	1.327 <i>8.08</i>	0.49 <i>11.02</i>	0.95 <i>6.60</i>
1.11-1.16	12	1.13 <i>4.80</i>	1.54 <i>11.45</i>	1.357 <i>10.02</i>	0.53 <i>9.15</i>	1.01 <i>7.60</i>
1.17-1.23	5	1.21 <i>1.36</i>	1.70 <i>3.82</i>	1.404 <i>4.26</i>	0.58 <i>13.10</i>	1.12 <i>5.15</i>
44 male <i>minutus</i> .						
0.78-0.83	4	0.79 <i>11.73</i>	0.89 <i>9.56</i>	1.126 <i>8.28</i>	0.29 <i>21.55</i>	0.61 <i>11.15</i>
0.84-0.89	12	0.86 <i>11.30</i>	1.09 <i>10.75</i>	1.261 <i>12.65</i>	0.37 <i>11.95</i>	0.71 <i>13.01</i>
0.90-0.95	11	0.92 <i>3.77</i>	1.28 <i>7.47</i>	1.384 <i>7.01</i>	0.44 <i>7.60</i>	0.84 <i>8.08</i>
0.96-1.01	9	0.98 <i>1.14</i>	1.45 <i>6.27</i>	1.479 <i>5.90</i>	0.52 <i>11.24</i>	0.94 <i>6.24</i>
1.02-1.08	8	1.04 <i>5.79</i>	1.56 <i>6.60</i>	1.490 <i>6.67</i>	0.56 <i>18.38</i>	1.00 <i>14.90</i>

mean. The column A/E gives the ratio mean antennal/mean elytra length and it will be seen that the ratio becomes steadily greater with increasing elytra length, demonstrating that the antennae exhibit positive differential growth. In arriving at the values of A/E, the ratio was calculated individually for each specimen and the group means then taken, so as to get a greater degree of accuracy than would result from dividing the means of the antennal lengths by those of the elytra. The ratios given in the other tables were calculated directly from the means of the antennal and elytral lengths, and the thorax widths, as the series of specimens are smaller and do not justify a greater degree of accuracy.

Fig. 1 is the graph obtained when the logarithms of the elytra length = x are plotted against those of the antennal length = y . It will be seen that the points do not fall quite on a straight line, but form a very gentle sigmoid curve suggesting that the value of k is not constant, but rises to a maximum in specimens of medium size and then falls again in those of the largest size. The angle that the line makes with the x axis is 62.5° , which gives a value for k of 1.92. The length of the last three segments of the antennae was measured to discover whether there was what Huxley (1932) terms a growth gradient; that is to say, whether the rate of differential growth, as measured by k , was greater in one part of the antennae than in another. The logarithms of the values for the last three segments of the antennae, and for the remainder of the antennae, were plotted separately against those for the elytra, but the value of k was the same for both, 1.88, which means that there was no appreciable growth gradient between the last three segments of the antennae and the remainder. This was confirmed by plotting the values of the last three segments against those of the remainder, treating the latter as the standard dimension, x ; the resulting line had a slope of exactly 45° ($k = 1$).

In another series of 27 males the width of the thorax was measured (see table IV). The logarithms of the mean values of the thorax widths were plotted against those of the elytra lengths as before, but the slope of the line did not depart significantly from 45° , and it may be said that in this small series no differential growth of the thorax with respect to width was detected.

Females. In a series of 20 female *L. turcicus*, the length of the antennae and elytra and the width of the thorax were measured (table III). No differential growth of the antennae was detected, but the width of the thorax showed a definite negative differential growth with respect to the length of the elytra; the slope of the line was 39° ($k = 0.81$).

Differential growth in L. minutus Olivier.

This species forms an interesting contrast to *turcicus*, for it displays a distinctly greater degree of differential growth in both sexes.

Males. In a series of 44 males (see table II) the same parts were measured as in the males of *turcicus*. Fig. 2, which corresponds to fig. 1, is the graph obtained when the logarithms of the mean antennal lengths are plotted against those of the elytra. The series was divided into five size groups, and it will be seen that while the first four points on the graph lie nearly on a straight line, the fifth is some way below this line. It is possible that the specimens with an elytra length of more than 1.02 mm. (see table II) have a value of k distinctly lower than that of smaller specimens. Huxley has found that a differentially growing organ may display two apparently disconnected growth curves each with a different value of k , and each value of k holding good over a certain part of the size range of the organ. Further data would be necessary

TABLE III.

Grouped data. Measurements in millimetres. The figures in *italics* are the values of *C*, the coefficient of variability.

E. Mean elytra lengths	No. of specimens per group	A. Mean antennal lengths	T. Mean thorax widths	A/E	T/E
20 male <i>ferrugineus</i> .					
1.00 <i>4.55</i>	4	0.85 <i>4.89</i>	0.49 <i>17.62</i>	0.850	0.494
1.04 <i>6.60</i>	5	0.91 <i>9.65</i>	0.52 <i>20.60</i>	0.874	0.500
1.11 <i>10.78</i>	5	0.99 <i>16.18</i>	0.56 <i>9.00</i>	0.891	0.507
1.18 <i>5.26</i>	6	1.06 <i>6.27</i>	0.60 <i>19.98</i>	0.894	0.507
20 female <i>turcicus</i> .					
0.93 <i>8.01</i>	5	0.85 <i>12.79</i>	0.43 <i>6.11</i>	0.910	0.464
1.00 <i>13.99</i>	5	0.88 <i>10.60</i>	0.46 <i>7.16</i>	0.885	0.464
1.05 <i>6.38</i>	5	0.94 <i>13.85</i>	0.48 <i>17.90</i>	0.896	0.457
1.19 <i>5.70</i>	5	1.07 <i>10.43</i>	0.53 <i>5.00</i>	0.899	0.447
20 female <i>minutus</i> .					
0.82 <i>23.10</i>	5	0.69 <i>19.05</i>	0.41 <i>25.28</i>	0.845	0.500
0.90 <i>16.05</i>	5	0.77 <i>7.35</i>	0.46 <i>8.72</i>	0.860	0.506
1.00 <i>10.05</i>	5	0.89 <i>12.42</i>	0.51 <i>25.10</i>	0.890	0.512
1.05 <i>16.29</i>	5	0.93 <i>5.92</i>	0.55 <i>10.58</i>	0.885	0.526

to decide whether this occurs in this instance, or whether there is merely a gradual fall in the value of *k* near the upper limit of the size range, as frequently occurs. Reference to table II will show that the values of *C* (coefficient of variation) for the mean antennal and elytral lengths in this largest size group (elytra length 1.02–1.08 mm.) are smaller than the values for the two smallest size groups. This means that the variation in the elytral and antennal lengths in this largest size group is less than in the two smallest groups, the means of which fall on a straight line; so that the fact that the means of this largest size group do not fall on the line is unlikely to be due to chance, and may be assumed to indicate a true decrease in the value of *k*.

TABLE IV.

Grouped data. Measurements in millimetres. The figures in *italics* are the values of *C*, the coefficient of variability.

E. Mean elytra lengths	No. of specimens per group	T. Mean thorax widths	T/E
27 male <i>turcicus</i> .			
0.91 <i>5.75</i>	7	0.45 <i>9.12</i>	0.494
1.01 <i>13.47</i>	8	0.48 <i>14.68</i>	0.476
1.14 <i>2.85</i>	9	0.58 <i>14.38</i>	0.505
1.22 <i>1.56</i>	3	0.62 <i>2.72</i>	0.507
36 male <i>minutus</i> .			
0.79 <i>13.22</i>	3	0.42 <i>6.98</i>	0.535
0.86 <i>10.58</i>	7	0.46 <i>23.60</i>	0.535
0.92 <i>4.07</i>	10	0.52 <i>24.40</i>	0.565
0.97 <i>9.55</i>	8	0.56 <i>11.43</i>	0.580
1.04 <i>5.78</i>	8	0.61 <i>12.00</i>	0.580

In the males of *minutus*, unlike those of *turcicus*, the antennae do display a growth gradient. It will be seen from table V, which summarises the values

TABLE V.

Values of *k*, the coefficient of differential growth ratio.

Species of <i>Laemophloeus</i>		Length of elytra = standard dimension				Length of antenna less last 3 segments = standard dimension
		Antennae			Thorax width	Last 3 segments of antennae
		Whole	Last 3 segments	Re- mainder		
<i>turcicus</i>	♂♂	1.92	1.88	1.88	1.07	1.00
	♀♀	1.03	—	—	0.81	—
<i>minutus</i>	♂♂	2.25	2.60	2.00	1.33	1.23
	♀♀	1.23	—	—	1.13	—
<i>ferrugineus</i>	♂♂	1.30	—	—	1.19	—

of k , that the last three segments of the antennae in male *minutus* display positive differential growth with respect to the remainder ($k = 1.23$). When the values of the two parts of the antennae are plotted against those of the elytra, the values of k are 2.60 for the last three segments and 2.00 for the remainder, and the mean of these two values, 2.30, is very close to that for the whole antennae (2.25), as it ought to be.

The width of the thorax (see table IV) also displays positive differential growth with respect to the length of the elytra ($k = 1.33$).

Females. In the females of *minutus* (table III) there is positive differential growth of the antennae ($k = 1.23$) and of the width of the thorax ($k = 1.13$).

Differential growth in L. ferrugineus Stephens.

In a series of 20 male *ferrugineus* the length of the antennae and elytra and the width of the thorax were measured (table III). A small degree of positive differential growth of the antennae ($k = 1.30$) and width of the thorax ($k = 1.19$) was found.

DISCUSSION.

In addition to the considerable interspecific and intersexual differences in the values of k (see table V), there are other metrical differences which are shown by the various tables. For example, it will be seen from table II that the antennae of male *minutus* are longer than those of male *turcicus* of equal elytra length (size); for instance, *L. turcicus* with a mean elytra length of 1.02 mm. have a mean antennal length of 1.27 mm., while *minutus* with a mean elytra length of 1.04 mm. have a mean antennal length of 1.56 mm., but the ranges in length of the antennae overlap broadly. The same is true of the width of the thorax (table IV). If the values of the ratio antennal length divided by elytral length (A/E) in the males of *minutus* and *turcicus* are examined (table II, A/E), it will be seen that the range of values of this ratio also overlap broadly, but the values of the ratio thorax width/elytral length (T/E) do not (table IV), for the thorax of *minutus* is always relatively wider than that of *turcicus*.

Much the same is true of the females of these species. The length of the antennae is about the same in specimens of equal size (table III), but the width of the thorax is greater in *minutus* than in *turcicus* of equal size. The values of the ratio A/E overlap, but those of T/E do not, the values being higher in *minutus*.

The various differences recorded here in the values of k , and in the absolute and relative sizes of certain parts of the body, are probably quite as much characters of the species as the purely qualitative ones, such as the nature of the punctures. The presence of the latter type of character makes it unnecessary, for purposes of identification, to employ the former; though it might be less troublesome to determine the ratio thorax width/elytra length than to examine the genitalia. One might give the following as a supplement to the key on p. 29.

Ratio thorax width/elytra length.

	<i>L. turcicus</i>	<i>L. minutus</i>
♂♂	0.49-0.51	0.53-0.58
♀♀	0.46-0.45	0.50-0.53

Although the ratio thorax width/elytra length is probably not of much practical importance in distinguishing between *O. minutus* and *turcicus*, it is interesting to note that Johnson (1939) found that the ratio head width/length of 3rd antennal segment was the most reliable character for distinguishing between *Cimex lectularius* L., the bed bug, and *C. columbarius* Jenyns, the pigeon bug. Johnson found that the ratio length of 3rd/length of 4th antennal segment, which was formerly used for distinguishing these insects, was of very little use because the range of values of the ratios overlap completely. For the same reason the ratio antennal length/body length is of no use for distinguishing between the males of *L. minutus* and *turcicus* (see table I). Johnson also found that the values of the ratio length of 3rd/length of 4th antennal segment increased during the growth of the insect; that is to say, the growth rate of the 3rd segment was greater than that of the 4th, and there was therefore relative growth between these two segments.

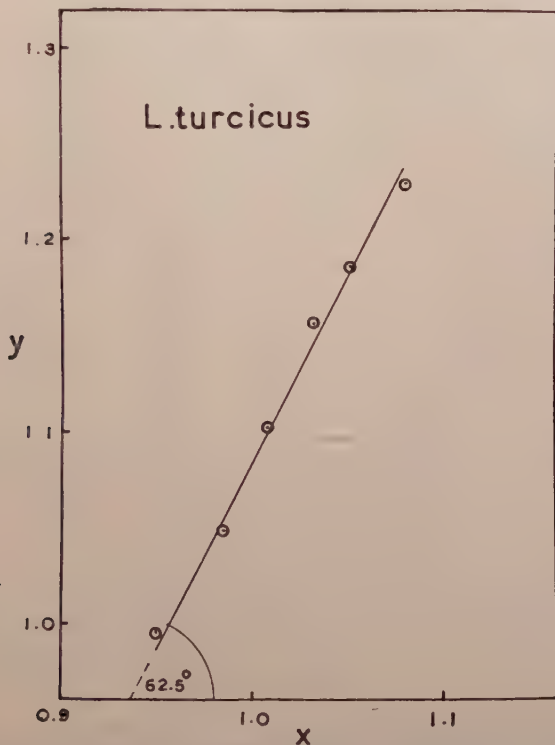


FIG. 1.—*L. turcicus* Grouvelle. Males. Graph of the logarithms of the mean elytra lengths, x , plotted against the logarithms of the mean antennal lengths, y . To avoid minus quantities the values of the means have been multiplied by 10.

Table III shows that in the males of *ferrugineus* the ratio length of antenna/length of elytra varies between 0.85 and 0.89, values which are much the same as those of the females of *minutus* and *turcicus*. In the males of the last two species the value of the ratio is always more than unity, as the antennae are always longer than the elytra. Richards (1938) has suggested that if metrical characters of this sort were determined for most of the members of a group, it might be found that the values always lay between certain limits; these

values might then be used to determine whether or not particular forms belonged to the group. In the present instance the possession by the male of antennae shorter or longer than the elytra might be a character of this sort; *L. ferrugineus* and the species near to *ater* belonging to one group, and *L. minutus* and *turcicus* to the other.

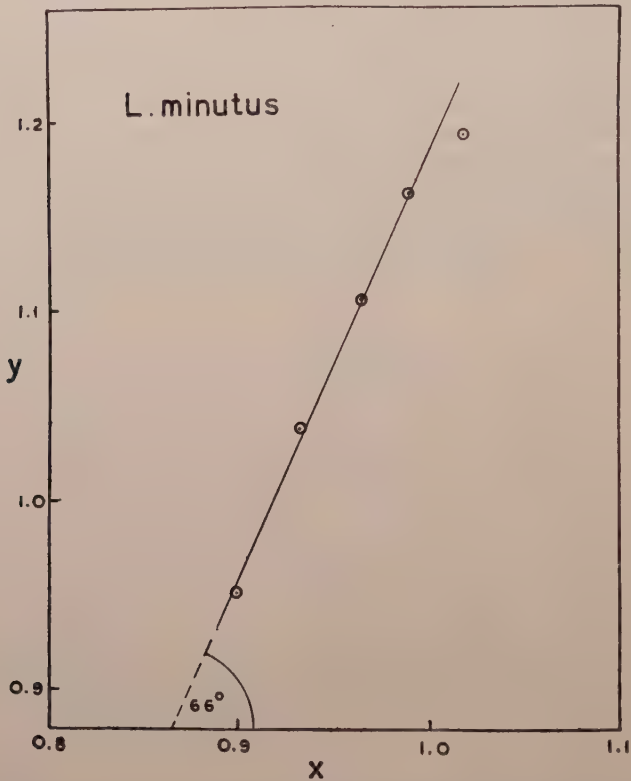


FIG. 2.—*L. minutus* Olivier. Males. Graph of the logarithms of the mean elytra lengths, x , plotted against the logarithms of the mean antennal lengths, y . To avoid minus quantities the values of the means have been multiplied by 10.

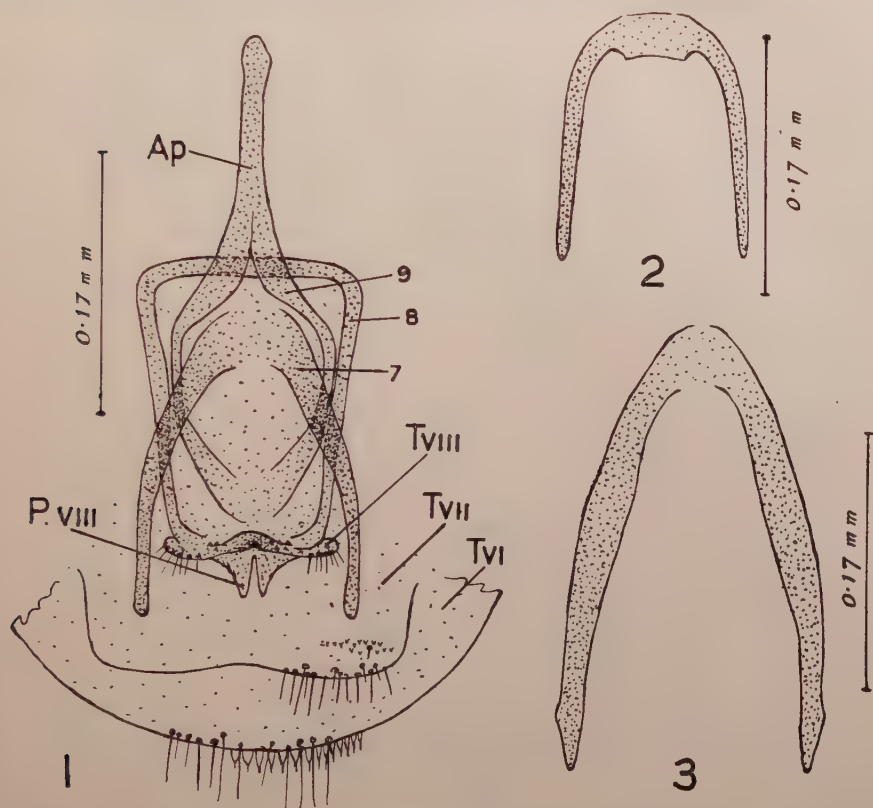
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 RICHARDS, O. W., and HERFORD, G. V. B., 1930, Insects found associated with cacao, spices and dried fruits in London warehouses. *Ann. appl. Biol.* **17** : 367–395, 10 pls.

THE SPECIES OF *LAEMOPHLOEUS* (COLEOPTERA: CUCUJIDAE) OCCURRING IN STORED FOODS IN THE BRITISH ISLES

By J. A. REID, B.Sc., A.R.C.S., F.R.E.S.

Two or three species of small beetles of the genus *Laemophloeus* are frequently found in stored products, such as grain, cacao, spices, etc., in the British Isles. Identification was found difficult, and the object of the present study was to discover satisfactory characters for the separation of these species.



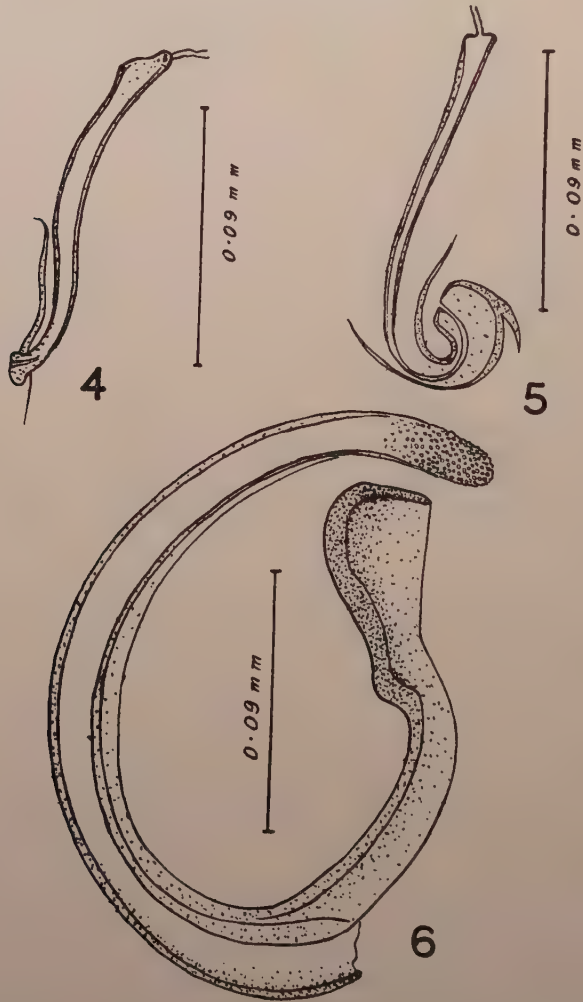
FIGS. 1-3.—1, *L. turcicus* Grouvelle male; sclerotisations associated with abdominal segments VII-IX; 7, 8, 9, sclerotisations of respective segments, Ap, apodeme on sclerotisation of IX, P.VIII, process of tergite VIII, T.VI-VIII, tergites. 2, *L. minutus* Olivier male; sclerotisation of segment VII. 3, *L. ferrugineus* Stephens male; the same.

The work was done at the Field Station of the Imperial College of Science and Technology, under the direction of Professor J. W. Munro, to whom I wish to express my thanks. I thank also Dr. K. G. Blair of the British Museum (Natural History) for kind assistance.

The difficulty was to distinguish between *Laemophloeus ferrugineus* Stephens, *L. minutus* Olivier (*pusillus* Schönherr), and *L. turcicus* Grouvelle, and little

progress was made until the genitalia were examined. The genitalia and associated structures were found to provide a sure means of separating either sex of these three species; after this discovery external differences were found which are incorporated in the key.

When the species were separated, it was noticed that the length of the antennae in the males of *L. minutus* and *L. turcicus* varied between very wide limits. Dr. O. W. Richards, to whom I am much indebted for valuable advice, suggested that these organs might display heterogonic growth of the type investigated by J. S. Huxley (1932). The essence of this type of variation is that the organ concerned, instead of forming a constant proportion of the total bulk of the animal, is relatively larger with respect to the rest of the body, in large specimens than in small.



FIGS. 4-6.—4, *L. turcicus*, female; sclerotised portions of spermatheca. 5, *L. minutus*, female; the same. 6, *L. ferrugineus*, female; the same.

A series of measurements was made, and analysis of the figures (data to be published elsewhere) showed that the antennae of the males in *L. minutus* and *L. turcicus* did in fact exhibit heterogony. The great variability in the length of the antennae was one of the main causes of the difficulty experienced in identification. If the key given by Richards and Herford (1930 : 370) is used and reliance is placed mainly on the antennal characters, large males of both *turcicus* and *minutus* would probably be identified as *turcicus*, and small males of both species as *minutus*.

I. A key to the species of *Laemophloeus* recorded from stored products in the British Isles.

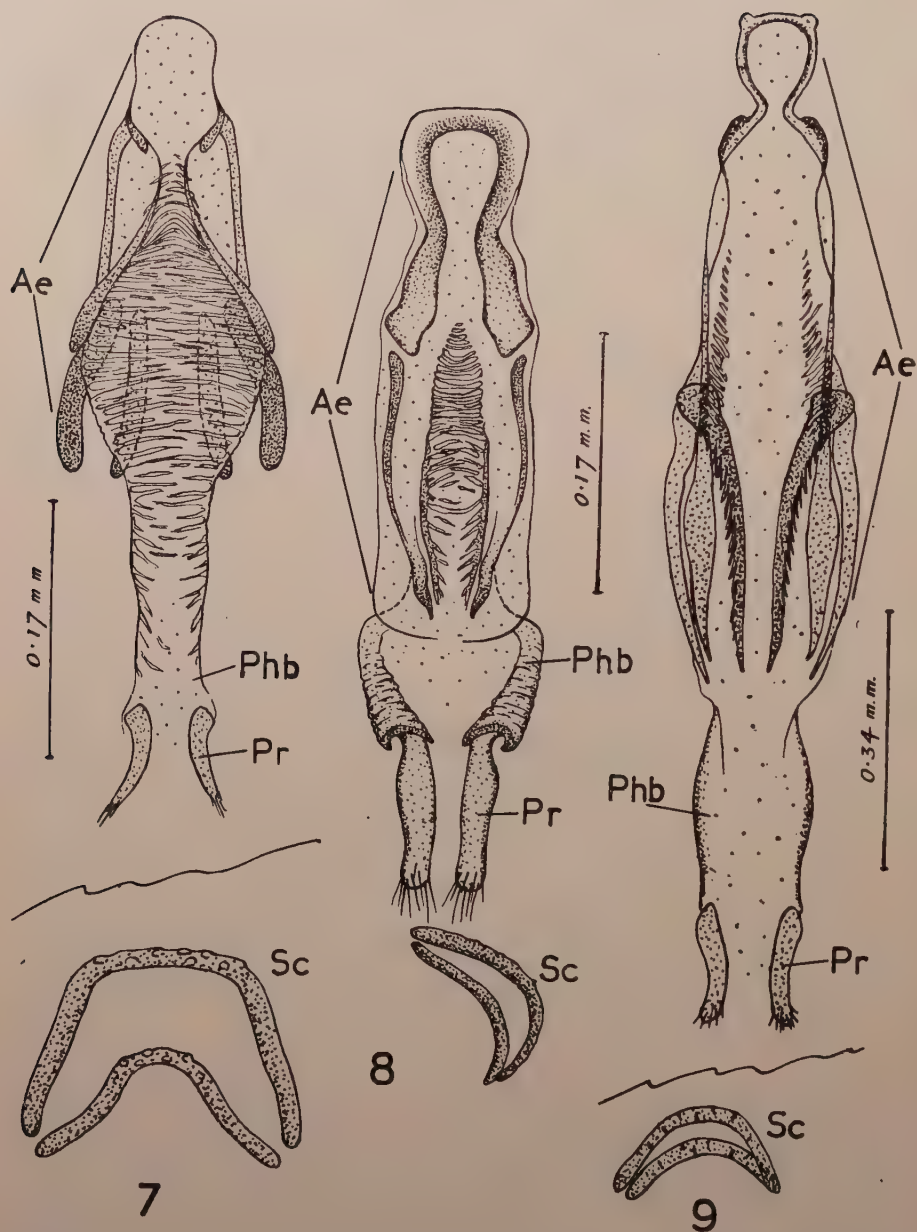
1. Hind angles of the thorax blunt. Species somewhat resembling *ferrugineus* but thorax more slender Species indet., near *ater* Erichson.
- Hind angles of the thorax sharp pointed. 2.
2. Scutellum triangular. Thorax more shining with strong side keels, and the hind angles produced into fine points. Elytra relatively smooth and shining *janeti* Grouvelle.
- Scutellum strongly transverse. Thorax less shining, the side keels less developed and the hind angles less sharply produced. Elytra duller 3.
3. Thorax strongly to moderately contracted behind. Antennae not more than half the body-length, the terminal segment not more than twice as long as broad, almost parallel-sided (fig. 10). Head and thorax finely and usually sparsely punctured. Males with a blunt tooth on the ventral side of each mandible near the base *ferrugineus* Stephens.
- Thorax only slightly contracted behind. Antennae from a half to more than three-quarters the body-length; length of terminal segment varying accordingly, if only about twice as long as broad (♀♀), not parallel-sided but widening distally (fig. 11). Head and thorax nearly always more strongly and closely punctured. Males without a tooth on the ventral side of the mandibles near the base. 4.
4. Thorax distinctly transverse, without a small median longitudinal impunctate area, the punctures small to moderate sized. Front angles of the thorax slightly more rounded, hind angles slightly less acute. Eyes less convex. Terminal segment of the antennae in the males a little less expanded distally (fig. 13) *minutus* Olivier.
- Thorax not distinctly transverse, often with a small median longitudinal impunctate area, the punctures usually large and shallow. Front angles of the thorax less rounded, hind angles more acute. Eyes more convex. Terminal segment of the antennae in the males a little more expanded distally (fig. 12) *turcicus* Grouvelle.

Specimens of all the species except *L. janeti* have been compared with material in the British Museum.

Joy (1932) gives the following key for separating *L. turcicus* and *minutus* :—

- Eyes less convex; thorax less strongly punctured; joint 3 of antennae shorter than 2 and 4 *minutus*.
- Eyes more convex; thorax more strongly punctured; joint 3 of antennae as long as 2 and 4 *turcicus*.

The difference in the convexity of the eyes appears to be a sound character and has been included in the key, but the antennal character does not seem to me to hold good.



FIGS. 7-9.—7, *L. turcicus*; sclerotised parts of male genitalia, ventral view; Ae, aedeagus, Phb, phallobase, Pr, parameres, Sc, sclerotisations, possibly in the walls of the genital chamber. 8, *L. minutus*; the same. 9, *L. ferrugineus*; the same.

The key I have given includes the four species recorded by Richards and Herford (1930), plus a fifth (species near to *ater*) discovered during the course of the work, among the material of *ferrugineus* in the collection at the Field Station. There were 3 females and 1 male of this species, taken in wheat refuse in a mill at Sonning, Berks, October 1929. Using Reitter's key (*Fauna Germanica*, *Käfer*) this species runs down to *ater* Erichson, but comparison shows that it is not the same as the species recognised in this country as *ater*, although related to it. The group of species to which it evidently belongs, in company with *ater* and *ferrugineus*, is characterised by the short antennae in both sexes, the presence of a tooth on the underside of the mandibles near the base in the males, and the marked contraction of the thorax behind, especially in the males. The species in question is more slender than *ferrugineus*, while the mandibles and labrum, especially in the male, are relatively larger, and the antennae a little shorter; the colour is more or less ferruginous.

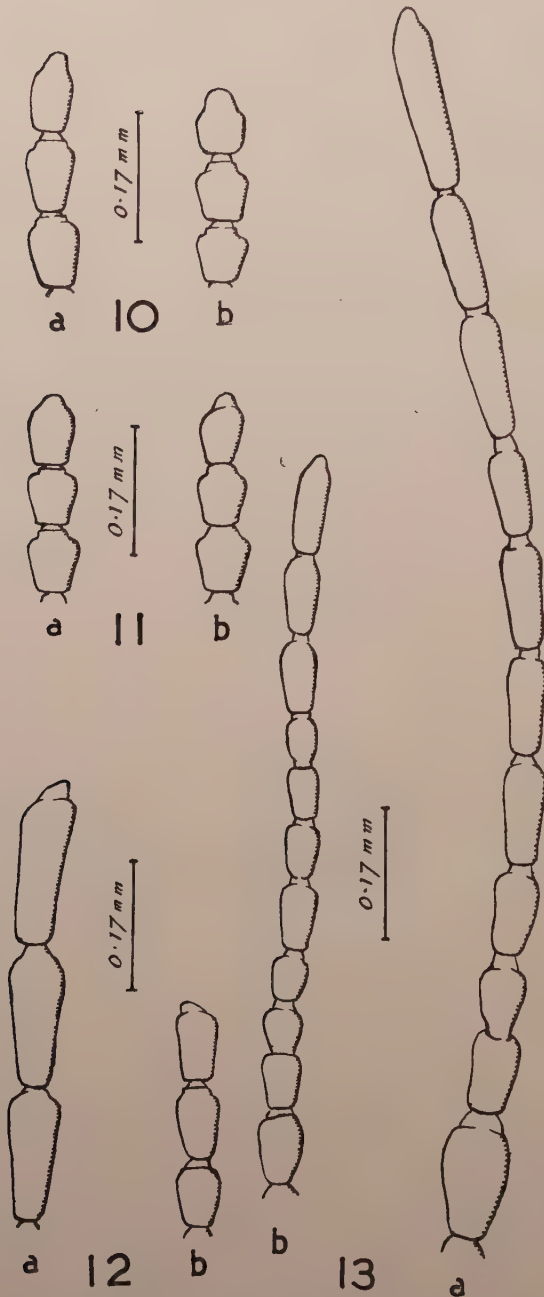
Richards and Herford record *L. ferrugineus* and *L. minutus* as cosmopolitan; they are certainly the commonest species in stored products in Britain. *L. turcicus* was first recorded in this country by Joy (1925) from a flour mill at Twyford near Reading, 18 Sept. 1924, and again (Joy, 1932) from a granary in Reading, 2 Feb. 1932. There are specimens in the collection at the Field Station from a mill at Sonning, Berks, Oct. 1929, and from a mill in Reading, Aug. 1930; evidently this species is established in the Reading district. *L. janeti* is recorded by Richards and Herford from a single adult specimen found in cacao from West Africa, at Wapping, London, 4 May 1928.

II. The genitalia and associated structures.

It may be appreciated from examination of the key that the external differences, especially between *L. minutus* and *turcicus*, are small and variable, but, as figs. 1 to 9 show, it is quite otherwise with the genitalia. In order to examine these structures the abdomen was dissected off and treated with potash, washed in acetic acid and then placed on a slide in a drop of de Faure's fluid. The tergites were separated from the sternites with fine needles and the genitalia came away with the tergites and could then be examined under the microscope. Only the genitalia of *L. ferrugineus*, *minutus* and *turcicus* have been examined.

Fig. 1 is a ventral view of the sclerotisations associated with segments VII to IX in the male of *turcicus*; the genitalia are not shown. Except for the sclerotisation of segment VII (figs. 1, 2 and 3), the shape of which is specific, the appearance of these structures in the males of *minutus* and *ferrugineus* is very similar to that of *turcicus*. The females have the usual rod-like sclerotisations in the walls of the last few segments of the abdomen, but these do not show specific differences. The females are readily identified by the shape of the sclerotised portion of the spermatheca (figs. 4, 5 and 6). The sclerotised portions of the male genitalia are depicted in ventral view in figs. 7, 8 and 9; no serious attempt has been made to interpret their structure, but it will be seen that almost every part differs among the three species. The shape of the parameres (Snodgrass, 1935: 597, = lateral lobes, Sharp and Muir, 1912) differs in the three species, but the larger differences occur in the sclerotisations of the aedeagus.

It is convenient to be able to distinguish the sexes of *L. ferrugineus*, *turcicus* and *minutus* from external features. Many parts of the body display some degree of difference in the sexes. The tarsal formula of the males is 5. 5. 4., that of the females 5. 5. 5. The antennae of the males, particularly in large specimens of



FIGS. 10-13.—10, *L. ferrugineus*; a, male, last three segments of antenna; b, female, the same. 11; a, *L. minutus*, female, last three segments of antenna; b, *L. turcicus*, female, the same. 12, *L. turcicus*, male, last three segments of antenna; a, large specimen; b, small specimen. 13, *L. minutus*, male, whole antenna; a, large specimen; b, small specimen.

minutus and *turcicus*, are longer than those of the females, though not much so in *ferrugineus*. The last three segments of the antennae in the females are always stouter and shorter than those of the males; this difference is very marked between large males of *minutus* and *turcicus* and females of these species. The thorax tends to be more contracted behind and its maximum width relatively greater in the males, especially those of *ferrugineus*; also the head of the males tends to be somewhat larger. There are other small differences, but usually the antennal characters form the easiest means of sexing mounted specimens (figs. 10 to 13).

It may be mentioned here as a point of interest that both sexes of these three species have what appears to be stridulatory apparatus. This consists of two pairs of file areas; each pair is composed of an area on the inside of the elytra near the outer edge towards the base and one that appears to be on the mesepimeron of the metathorax. The appearance of the apparatus is the same in all three species; the file areas consisting of a large number of minute teeth set close together, and all sloping the same way.

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BOOK NOTICE.

The biological campaign against prickly-pear. By A. P. DODD. 8vo. Brisbane (Commonwealth Prickly Pear Board), 1940. pp. ii + 177, 37 pls., 6 graphs, 1 map.

"This bulletin is intended to be a record of the biological investigations carried out during the campaign" [against the prickly-pear]. This is the statement given in the Introduction to the work. It is known generally that the problem of eradication of the cactus known as Prickly-Pear in Australia was probably the foremost problem confronting the Governments of Queensland and New South Wales from 1920 to 1940. At the height of its spread the cactus had made virtually useless an area of approximately 60,000,000 acres, the reclamation of which by mechanical or chemical methods was out of the question by reason of the expense. The whole of this area has been, or will very shortly be, so cleared of the weed that it may be utilised for agricultural purposes.

This book is the story of that achievement. It is a full historical summary of the origin, study and results obtained by the Commonwealth Prickly Pear Board which was set up in 1920 and terminated in 1939. The success of the control is of course due to the moth *Cactoblastis cactorum*, a native of the Argentine, a gregarious feeder which tunnels in the segments and stems of the prickly-pear and reduces the plants to a rotting mass.

A special welcome may be accorded to this most interesting record of a very spectacular success in the control of a first-rate plant-pest by an insect. It is worthy of a very wide distribution.

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„ May	6
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